

NEMATODE PARASITES OF MAMMALS.

WITH A DESCRIPTION OF A NEW SPECIES,
WELLCOMIA BRANICKII.

FROM SPECIMENS COLLECTED IN THE NEW YORK
ZOOLOGICAL PARK, 1930.

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I. INTRODUCTION.

(Fig. 1.)

For the last two years the writer has been engaged in parasitological research in the Animal Hospital Laboratory of the New York Zoological Park. Parasitism, as a biological phenomenon, has long been recognized, and a glance at medical history convinces one of the importance of such a study. It is not only important from the standpoint of human disease, but equally important from a domestic and agricultural standpoint. The New York Zoological Park offers excellent opportunities for the development of a Biological Research Laboratory within its own boundary.

Each year a varying number of animals die from one cause or another, and a careful examination is made at autopsy by Dr. Charles V. Noback, Park Veterinarian, for pathological data and to determine the immediate cause of death. Various internal parasites such as flukes, tapes, and round worms, are encountered. Among

these, round worms are by far the most numerous, and as the study to date has been chiefly among mammals, it was thought advisable to include only data pertaining to nematode parasites from this group. In making a study of this nature it is important to determine the sources of infestation. The distribution, food, habits, and duration of captivity of the host, together with a detailed knowledge of the morphology, life history, and habitat of the parasite involved are essentials that must not be overlooked.

The heaviest mortality occurs among recent arrivals in the park. These invariably harbor the greatest variety and the largest number of parasites. Observations of workers (Fox, 1923) in the field support the theory that most animals in captivity obtain their parasites from the region from which they were taken. During this year in the case of two kit or swift foxes, *Vulpes velox*, from New Mexico, one died enroute to the park, and at autopsy both *Physaloptera* and *Toxascaris* were obtained. Fecal examinations of the other showed ova of both species in abundance. On the other hand, in the case of a polar bear, *Thalarctos maritimus*, that had been in the park twenty years, 169 *Toxascaris transfuga* were taken at autopsy, which may indicate that reinfestation occurs in the park. However, it is not the purpose to discuss further the sources of infestation, but rather to record the data collected from the material at hand. The primary purpose of this report is to bring together under one binding the literature pertaining directly to our own specific needs; however, it is hoped that other workers in the field may find it useful.

II. ACKNOWLEDGMENTS.

The writer wishes to express his gratitude to the New York Zoological Society for the publication, and the grant that made this study possible; to Dr. W. Reid Blair, Director of the New York Zoological Park—for the use of the laboratory facilities where the major part of the work was done; and to Dr. Charles V. Noback, Park Veterinarian, for the material placed at his disposal, and for many helpful suggestions throughout the study.

Thanks are due to Dr. M. C. Hall and his associates for the assistance in identification and advice in general methods of procedure while the writer was a guest in the Laboratory of the U. S. Department of Agriculture, Washington, D. C. To Dr. E. W. Price, and to Dr. B. G. Chitwood, the writer expresses his appreciation for

the examination and helpful suggestions in the description of the new species.

Grateful acknowledgments are due Dr. Charles H. Willey, New York University, for assisting in the preparation of the manuscript.

III. TECHNIQUE AND METHODS OF PROCEDURE.

The information contained in this report was obtained from the study of a collection of nematode parasites collected from mammals that died in the New York Zoological Park during the year 1930. At autopsy the mesentery holding the various organs intact was carefully cut away and the organs extended and dissected. The intestine was opened with an enterotome and the mucous lining scraped in order to detach any adherent parasites. Each organ was placed in a separate jar of water and vigorously washed. After a few minutes, parasitic worms, if any were present, settled to the bottom together with heavier ingesta. The water was decanted, leaving only sediment, and more water was added. The same process was repeated until the liquid no longer became turbid when the contents of the jar was stirred. The water was then poured off and physiological salt solution added. The parasites may be kept alive in this solution for several hours.

Two methods of killing and fixing were employed. The worms were placed in 10 percent formalin for a period of ten minutes, and then transferred directly to lactophenol (for formula see Ward and Whipple 1918, *Fresh-Water Biology*, p. 508) which dehydrates, preserves, and clears. Unfortunately, some worms treated by this method deteriorated and were rendered useless. The best method employed was to kill the worms in hot 70 percent alcohol. To this solution a small amount of glycerine may be added. Nematodes stored in this solution may be cleared quickly in lactophenol or any other clearing agent for immediate use.

Measurements were obtained as follows, and the results recorded in millimeters and microns. The worms were first placed under a dissecting microscope on a graduated glass slide, 100 mm. long. The length of the worms together with relative positions of various organs were obtained in this manner. Then the worms were transferred to a compound microscope, where minute measurements of various organs were made by means of an ocular micrometer. Curved organs like the spicuales etc. were projected with a camera

lucida, and the magnification ascertained. Outline drawings were made in this manner. For more detailed observations, permanent glycerine jelly mounts were made from dissections of the worms, and these studied with an oil immersion lens. With this information in hand a careful review of the literature was made. In a few cases where identification was not definite the abbreviation sp. was employed.

In Part IV. the systematic arrangement of the hosts is that adopted by Flower (1929). The dates of arrival and death are given, and the time in captivity may be ascertained. The name and number of each nematode obtained, together with the location within the host is given.

In Part V. the zoological order of the nematodes is adopted from Yorke and Maplestone (1926) and the species are listed alphabetically. Whenever possible a detailed description, and in some cases a brief comment has been given followed by a list of the hosts from which the nematodes were taken.

IV. SYNOPTIC LIST OF MAMMALS FROM WHICH NEMATODE PARASITES WERE COLLECTED.

ORDER PRIMATES.

Family HYLOBATIDAE.

Hylobates hoolock, (hoolock gibbon) arrived 6/19/30; died 8/19/30.

3 *Oesophagostomum blanchardi*, intestine.

17 *Oxyuroidea* sp. (larvae) intestine.

18 *Physaloptera* sp. (larvae) stomach.

Symphalangus syndactylus, (black gibbon) arrived 2/13/29; died 7/8/30.

10 *Trichuris* sp. cecum.

Symphalangus syndactylus, (black gibbon) arrived 1/15/30; died 8/19/30.

1 *Trichuris* sp. cecum.

16 *Oesophagostomum apiostomum*, intestine.

1 *Oxyuroidea* sp. (larva) intestine.

5 *Physaloptera* sp. (larvae) stomach.

Family CERCOPITHECIDAE.

Pithecus entellus, (langur) arrived 9/28/29; died 12/17/30.

1 *Gongylonema pulchrum*, intestines.

Cercopithecus cephus, (moustache monkey) arrived 7/8/30; died 7/11/30.

3 *Trichuris* sp. cecum.

Cercopithecus cephus, (moustache monkey) arrived 7/8/30; died 10/3/30.

2 *Trichuris* sp. cecum.

4 *Subulura distans*, cecum.

- Cercopithecus sabaeus*, (green monkey) arrived 9/12/29; died 2/3/30.
55 *Subulura distans*, intestine.
- Cercopithecus sabaeus*, (green monkey) arrived 9/12/30; died 10/24/30.
4 *Trichuris* sp. intestine.
- Cercopithecus sabaeus*, (green monkey) arrived 4/25/30; died 10/14/30.
53 *Subulura distans*, intestine.
3 *Physaloptera* sp. (larvae) intestine.
- Cercocebus fuliginosus*, (sooty mangaby) arrived 10/30/30; died 12/27/30.
300 *Subulura distans*, cecum.
- Macaca irus*, (Java macaque) arrived 9/20/29; died 1/28/30.
3 *Subulura distans*, intestine.
- Macaca irus*, (Java macaque) arrived 9/20/29; died 4/2/30.
15 *Oesophagostomum apistomum*, intestine.
8 *Subulura distans*, intestine.
- Macaca mulatta*, (Rhesus monkey) arrived 9/23/29; died 8/15/30.
104 *Subulura distans*, intestine.
- Macaca mulatta*, (Rhesus monkey) arrived 10/23/29; died 8/15/30.
12 *Subulura distans*, intestine.
- Macaca fuscata*, (Japanese red-faced monkey) arrived 4/24/29; died 3/25/30.
5 *Subulura distans*, cecum.
- Macaca sylvana*, (barbara ape) arrived 4/14/30; died 7/2/30.
80 *Subulura distans*, intestine.
10 *Physaloptera caucasica*, stomach.
- Cynopithecus niger*, (black ape) arrived 5/31/30; died 10/4/30.
10 *Oesophagostomum apistomum*, intestine.

Family CEBIDAE.

- Cebus apella*, (weeper sapajou) arrived 2/14/30; died 6/20/30.
1 *Dipetalonema gracile*, body cavity.
- Cebus capucina*, (white-faced sapajou) arrived 11/27/29; died 11/12/30.
1 *Ancylostoma caninum*, intestine.
6 *Oxyuroidea* sp. (larvae) intestine.
13 *Physaloptera* sp. (larvae) intestine.
1 *Dipetalonema gracile*, body cavity.
- Cebus capucina*, (white-faced sapajou) arrived 11/2/29; died 9/5/30.
3 *Physaloptera* sp. (larvae) stomach.
- Lagothrix humboldtii*, (woolly monkey) arrived 3/8/30; died 4/3/30.
1 *Necator americana*, ilium.
27 *Enterobius* sp. intestine.
- Lagothrix humboldtii*, (woolly monkey) arrived 6/10/29; died 3/24/30.
20 *Trichostrongylus* sp. intestine.
33 *Dipetalonema gracile*, body cavity.
- Ateles ater*, (spider monkey) arrived 10/12/27; died 5/19/30.
55 *Enterobius* sp. intestine.
- Ateles ater*, (spider monkey) arrived 10/20/29; died 2/24/30.
2 *Strongyloidea* sp. intestine.
- Ateles ater*, (spider monkey) arrived 6/6/28; died 8/24/30.
1 *Dipetalonema gracile*, body cavity.

Order CARNIVORA.

Family FELIDAE.

Felis tigris, (tiger) arrived 11/4/22; died 6/16/30.

17 *Toxascaris leonina*, intestine.

10 *Toxocara mystax*, intestine.

Acinonyx jubatus, (cheetah) arrived 8/8/29; died 3/3/30.

59 *Toxascaris leonina*, intestine.

20 *Toxocara mystax*, intestine.

Family CANIDAE.

Vulpes fulva, (silver fox) arrived 7/2/29; died 2/23/30.

6 *Uncinaria stenocephalus*, intestine.

Vulpes zerda, (fennic fox) arrived 5/22/29; died 8/6/30.

1 *Ancylostoma duodenale*, intestine.

2 *Oxyuroidea* sp. intestine.

Family MUSTELIDAE.

Mephitis mephitis, (Canadian skunk) arrived 8/6/30; died 8/14/30.

144 *Physaloptera maxillaris*, stomach.

Family PROCYONIDAE.

Procyon lotor, (raccoon) arrived 1930; died 9/2/30.

2 *Ascaroidea* sp. stomach.

Thalarctos maritimus, (polar bear) arrived 9/10/10; died 2/26/30.

169 *Toxascaris transfuga*, intestine.

Order RODENTIA.

Family HYSTRICIDAE.

Hystrix leucura, (Indian porcupine) arrived 10/24/21; died 8/19/30.

1 *Oesophagostomum* sp. intestine.

Family ERETHIZONTIDAE.

Erethizon dorsatum, (Canadian porcupine) arrived 9/30/30; died 10/21/30.

50 *Wellcomia evoluta*, intestine.

Family DONOMYIDAE.

Dinomys branickii, (Branick rat) arrived 4/7/30; died 8/22/30.

1 *Trichurus* sp. cecum.

20 *Wellcomia branickii*, n. sp. intestine.

Family CUNICULIDAE.

Cuniculus paca, (spotted cavy) arrived 1/5/30; died 2/3/30.

5 *Heligmostrongylus sedecimradiatus*, cecum.

Cuniculus paca, (spotted cavy) arrived 8/19/30; died 8/25/30.

79 *Physaloptera torresi*, stomach.

Cuniculus paca, (spotted cavy) arrived 12/6/29; died 7/17/30.

49 *Physaloptera torresi*, stomach.

Family DASYPROCTIDAE.

Dasyprocta agouti, (golden agouti) arrived 1/7/30; died 6/22/30.

58 *Physaloptera torresi*, stomach.

Order LAGOMORPHA.

Family LEPORIDAE.

Lepus californicus melanotis, (Kansas jack rabbit) arrived 5/26/30; died 6/16/30.

4 *Obeliscoides cuniculi*, intestine.

Order ARTIODACTYLA.

Family BOVIDAE.

Bison bison, (American buffalo) arrived 4/9/16; died 11/14/30.

1 *Ascaroidea* sp. (broken) intestine.

Oribos moschatus, (musk ox) arrived 10/30/29; died 8/22/30.

Many *Trichuris* sp. cecum.

Damaliscus korrigum, (tiang) arrived 5/25/25; died 4/13/30.

6 *Capillaria* sp. intestine.

Antilope cervicapra, (blackbuck) arrived 9/8/27; died 11/10/30.

5 *Bunostomum trigonocephalum*, intestine.

Taurotragus oryx, (eland) arrived 5/6/29; died 10/8/30.

Many *Nematodirus* sp. intestine.

Family CERVIDAE.

Dama dama, (fallow deer) arrived 6/9/29; died 8/5/30.

101 *Trichuris* sp. cecum.

11 *Oesophagostomum venulosum*, intestine.

Dama dama, (fallow deer) arrived 6/9/29; died 8/5/30.

5 *Trichuris* sp. cecum.

13 *Oesophagostomum venulosum*, intestine.

Rucervus duvancelii, (Barasingha deer) arrived 5/13/29; died 10/2/30.

7 *Oesophagostomum venulosum*, intestine.

Cervus songaricus (Altai elk) arrived 7/15/14; died 7/2/30.

37 *Oesophagostomum venulosum*, intestine.

Order XENARTHRA.

Family DASYPODIDAE.

Euphractus sexcinctus, (6 banded armadillo) arrived 6/9/27; died 12/2/30.

19 *Aspidodera* sp. intestine.

V. SYNOPTIC LIST OF NEMATODE PARASITES.

Superfamily TRICHUROIDEA Railliet 1916.	
Family TRICHURIDAE Railliet 1915.	
Superfamily STRONGYLOIDEA Weinland 1858; Hall 1916.	
Family STRONGYLIDAE Baird 1853.	
Subfamily OESOPHAGOSTOMINAE Railliet 1915.	
Genus <i>Oesophagostomum</i> Molin 1861.	
<i>Oesophagostomum apistomum</i> (Willach 1891).....	10
<i>Oesophagostomum blanchardi</i> Railliet and Henry 1912	11
<i>Oesophagostomum venulosum</i> (Rudolphi 1809).....	11
Family ANCYLOSTOMIDAE (Looss 1905) Lane 1917.	
Subfamily ANCYLOSTOMINAE (Looss 1905) Stephens 1916.	
Genus <i>Ancylostoma</i> (Dubini 1843) Creplin 1845.	
<i>Ancylostoma caninum</i> (Ercolani 1859).....	12
<i>Ancylostoma duodenale</i> (Dubini 1843) Creplin 1845.....	12
Subfamily NECATORINAE Lane 1917.	
Genus <i>Necator</i> Stiles 1903.	
<i>Necator americanus</i> (Stiles 1902).....	13
Genus <i>Uncinaria</i> Froelich 1789.	
<i>Uncinaria stenocephala</i> (Railliet 1884).....	13
Genus <i>Bunostomum</i> Railliet 1902.	
<i>Bunostomum trigonocephalum</i> (Rudolphi 1808).....	13
Family TRICHOSTRONGYLIDAE Leiper 1912.	
Subfamily TRICHOSTRONGYLINAE Leiper 1908.	
Genus <i>Trichostrongylus</i> Looss 1905.	
Genus <i>Obeliscoides</i> Graybill 1924.	
<i>Obeliscoides cuniculi</i> (Graybill 1923).....	14
Genus <i>Nematodirus</i> Ransom 1907.	
Subfamily HELIGMOSOMINAE Travassos 1914.	
Genus <i>Heligmostrongylus</i> Travassos 1917.	
<i>Heligmostrongylus sedecimradiatus</i> (Linstow 1899).....	15
Superfamily OXYUROIDEA Railliet 1916.	
Family OXYURIDAE Cobbold 1864.	
Subfamily OXYURINAE Hall 1916.	
Genus <i>Enterobius</i> Leach 1855.	
Subfamily SYPHACINAE Railliet 1916.	
Genus <i>Wellcomia</i> Sambon 1907.	
<i>Wellcomia branickii</i> sp. nov.	16
<i>Wellcomia evoluta</i> (Linstow 1899).....	16

Family HETERAKIDAE Railliet and Henry 1914.	
Subfamily HETERAKINAE Railliet and Henry 1912.	
Genus <i>Aspidodera</i> Railliet and Henry 1912.	
Family SUBULURIDAE Yorke and Maplestone 1926.	
Subfamily SUBULURINAE Travassos 1914.	
Genus <i>Subulura</i> Molin 1860.	
<i>Subulura distans</i> (Rudolphi 1809).....	19
Superfamily ASCAROIDEA Railliet and Henry 1915.	
Family ASCARIDAE Baird 1853.	
Subfamily ASCARINAE (Railliet and Henry 1912) Travassos 1913.	
Genus <i>Toxocara</i> Stiles 1905.	
<i>Toxocara mystax</i> (Zeder 1800).....	20
Genus <i>Toxascaris</i> Leiper 1907.	
<i>Toxascaris leonina</i> (Linstow 1902).....	21
<i>Toxascaris transfuga</i> (Rudolphi 1819).....	21
Superfamily SPIRUROIDEA Railliet and Henry 1915.	
Family SPIRURIDAE Oreley 1885.	
Subfamily GONGYLONEMINAE Hall 1916.	
Genus <i>Gongylonema</i> Molin 1857.	
<i>Gongylonema pulchrum</i> Molin 1857.....	22
Family PHYSALOPTERIDAE Leiper 1908.	
Subfamily PHYSALOPTERINAE Railliet 1893.	
Genus <i>Physaloptera</i> Rudolphi 1819.	
<i>Physaloptera caucasica</i> von Linstow 1902.....	22
<i>Physaloptera maxillaris</i> Molin 1860.....	23
<i>Physaloptera torresi</i> (Travassos 1920).....	24
Superfamily FILARIOIDEA Weinland 1858; Stiles 1907.	
Family FILARIIDAE (Cobbold 1864) Claus 1885.	
Subfamily SETARIINAE Yorke and Maplestone 1926.	
Genus <i>Dipetalonema</i> Diesing 1861.	
<i>Dipetalonema gracile</i> (Rudolphi 1809).....	25

The family *Trichuridae* is represented by two genera, *Trichuris* Roederer 1761, and *Capillaria* Zeder 1800. As has been pointed out by Schwartz (1926) and others, certain specific characters, such as size, shape and armature of the spicule sheath, dimensions of the ova, etc. are very unsatisfactory in the genus *Trichurus*. Chandler (1930) suggested that if a more detailed description of the male gonads be added, the problem of differentiating species would be greatly simplified. He describes and figures six species.

There is only one species of the genus *Capillaria* represented and this together with the members of the genus *Trichuris* has been reserved for further study.

No. ¹	Hosts.
301, 302,	<i>Symphalangus syndactylus</i> , (black gibbon).
303, 304,	<i>Cercopithecus cephus</i> , (moustached monkey).
305,	<i>Cercopithecus sabaesus</i> , (green monkey).
306,	<i>Dinomys branickii</i> , (Branick rat).
307,	<i>Ovibos moschatus</i> , (musk ox).
308,	<i>Damaliscus korrigum</i> , (tiang).
309, 3010,	<i>Dama dama</i> , (fallow deer).

This genus (*Oesophagostomum*) is represented by three species, two from Primates, and one from deer. The specimens were all adults, living in the small intestine. The species *Oesophagostomum apiostomum* will be described in detail, while only the major distinguishing characters of *O. blanchardi*, and *O. venulosum* will be pointed out.

Oesophagostomum apiostomum (Willach 1891).

The males vary in length from 10 mm. to 12.8 mm., and in breadth from 405 μ to 565 μ . The body is attenuated both anteriorly and posteriorly. The cuticle is transversely striated at intervals of about 14 μ near the posterior end of the oesophagus. The cuticle between the mouth collar and the transverse groove is inflated to form a vesicular swelling. There are two lateral membranous wings that arise from the cervical groove and extend to a point near the end of the oesophagus.

The head bears 2 lateral and 4 submedian papillae. The submedian papillae are slightly bifurcated. The mouth collar is well developed, and the leaf crown consists of 10 to 13 elements. The mouth capsule has the shape of a truncated cone, and measures about 45 μ to 49 μ in diameter at the opening, and from 78 μ to 82 μ at the base. Its length is about 21 μ . The posterior margin of the mouth capsule is provided with three teeth. The internal leaf crown appears to be absent. The oesophageal funnel is well developed.

The oesophagus is club-shaped and measures about 615 μ in length, and from 74 μ minimum thickness, to 145 microns or more near the posterior end. The excretory pore is located on the ventral side of the body just behind the cervical groove, which is about 247 μ from the anterior end of the body. The nerve ring measures about 29 μ wide, and is located just posterior to the cervical groove. The cervical papillae are located just posterior to the middle of the oesophagus.

The median lobe of the bursa is somewhat emarginated in the median plane, does not protrude, and is separated by a shallow incision from each lateral lobe. The rays are curved. The common trunk of the dorsal rays measures about 99 μ long and the branches are about 154 μ long. From each branch about 58 μ

¹The numbers preceding the hosts are those of the preserved specimens, deposited in the laboratory of the New York Zoological Park.

from the bifurcation, a small external branch is given off. It is about 37μ long and turns posteriorly. The external dorsal ray measures about 184μ long and ends far from the border of the bursa. The ventral rays are united and end near the border of the bursa. From the common trunk the externo-lateral ray first comes off and ends at a rather long distance from the border of the bursa, while the medio- and postero-lateral rays, which run parallel, terminate at a short distance from the border. The spicules are subequal, measuring $1,285 \mu$ and $1,369 \mu$ respectively in length.

The females vary in length from 12 mm. to 16 mm., and in breadth from 458μ to 600μ . The general characters of the head region are about the same as described in the male. The oesophagus has the same shape, but is slightly longer and larger. Its length varies from 685μ to 720μ , and its diameter varies from 75μ at the smallest portion to 165μ near the posterior end.

The body tapers gradually to the anus. The distance between the vulva and the anus is about 206μ . The distance between the anus and the tail is about 200μ . The vagina is directed longitudinally, and measures about 200μ in length, and about 37μ in width. The combined length of the muscular portions of the two ovjectors, including the sphincters, is about 229μ . The non-muscular portions of the ovjector measure 265μ in length.

No. Hosts.

- 3011, *Symphalangus syndactylus*, (black gibbon).
 3012, *Cynopithecus niger*, (black ape).
 3013, *Macaca irus*, (Java macaque).

Oesophagostomum blanchardi Railliet and Henry 1912.

Only males of this species were found. They vary in length from 15.5 mm. to 16.5 mm., and in breadth from 529μ to 687μ . The cuticle is transversely striated at intervals of about 13μ near the posterior end of the oesophagus. The general shape of the body, head papillae, mouth collar, mouth capsule, teeth, excretory pore, cervical groove, cervical papillae and nerve ring, resembles *O. apiostomum*, however, the main distinguishing character is the presence of 16 external leaf-crown elements. The oesophagus is club-shaped and varies in length from 758μ to 934μ , from 88μ to 97μ minimum thickness anteriorly to 176μ to 229μ near the posterior end. The bursa is typical of *Oesophagostomum*. The spicules are subequal, left $1,446 \mu$ to $1,537 \mu$, right $1,449 \mu$ to $1,552 \mu$.

No. Host.

- 3014, *Hylobates hoolock*, (hoolock gibbon).

Oesophagostomum venulosum (Rudolphi 1809).

This species is recorded from three hosts, all of the family Cervicae. The males vary in length from 11 mm. to 16 mm., and in breadth from 335μ to 440μ . The cuticle is transversely striated at intervals of about 3μ or 4μ at the posterior end of the oesophagus. The general cephalic structures are typical of *Oesophagostomum*. The external leaf-crown consists of 16 to 18 elements, and the internal leaf-crown twice as many. The oesophagus is club-shaped and

measures from 829 μ to 846 μ in length, and from 103 μ to 107 μ minimum thickness anteriorly to 198 μ to 200 μ near the posterior end. The cervical papillae are small and are located just posterior to the oesophagus. The bursa is typical of *Oesophagostomum*. The spicules are sub-equal, measuring from 13 μ to 14 μ in length.

The females vary in length from 11.5 mm. to 16 mm. and in breadth from 423 μ to 494 μ . The general characters of the head region are similar to those of the male. The oesophagus has the same shape, but is slightly larger. Its length is about 847 μ , and its diameter varies from 124 μ at the smallest portion to 237 μ near the posterior end. The distance between the vulva and the anus is about 135 μ , and the tail measures about 115 μ . The vagina is directed longitudinally, and measures about 516 μ in length. The combined length of the muscular portions of the two ovijectors, including the sphincters, is about 248 μ . The non-muscular portions of the ovijector measure about 227 μ in length. The ova are ovoid and measure about 41 μ by 86 μ .

No.	Hosts.
3015, 3016,	<i>Dama dama</i> (fallow deer).
3017,	<i>Rucervus duvaucelii</i> , (Barasingha deer).
3018,	<i>Cervus songaricus</i> , (Altai elk).

This genus (*Ancylostoma*) is represented by two species, one from monkey and one from fox. The distinguishing characters of the genus are the number, size, and shape of the ventral teeth.

Ancylostoma caninum (Ercolani 1859).

Only one worm, a female, of this species was found. It was about 11 mm. long and 400 μ wide. The anterior extremity of the body was bent dorsally. The character that clearly distinguished this species was the presence of three pairs of well developed ventral teeth. The length of the oesophagus was about 1,100 μ . The vulva was located in the posterior third of the body and the tail was about 170 μ long. The ova measured 74 μ to 84 μ long and 48 μ to 54 μ wide.

No.	Host.
3019	<i>Cebus capucina</i> , (white-faced sapajou).

Ancylostoma duodenale (Dubini 1843) Creplin 1845.

Only one worm, a male, of this species was found. It was 7 mm. long and 405 μ wide. The anterior extremity of the body was bent dorsally. The presence of two pairs of well developed ventral teeth, and a rudimentary inner pair, places the species. The oesophagus was 1,100 μ long and 141 μ wide. The spicules were 1,587 μ long. The dorsal ray of the bursa was divided near its distal end, and each branch subdivided into three unequal branches.

No.	Host.
3020,	<i>Vulpes zerda</i> , (fennic fox).

Necator americanus (Stiles 1902).

Only one worm, a female, was found high up in the ileum. It was about 11 mm. long and 370 μ wide. There was a well developed mouth capsule and a pair of ventral cutting plates. The oesophagus was 700 μ long. The vulva was just anterior to the middle of the body. The tail was without a spine. The ova measured about 32 μ by 55 μ .

No. Host.

3021, *Lagothrix humboldtii*, (woolly monkey).

Uncinaria stenocephala (Railliet 1884).

Six specimens of this species, two males and four females, were found in the intestine of a silver fox. The males vary in length from 5.6 mm. to 8.5 mm. and in width from 211 μ to 229 μ . The anterior extremity of the body was bent dorsally. The cuticle was smooth and transparent, and measured about 6 μ to 10 μ in thickness at the base of the oesophagus. The buccal capsule was infundibular with two semilunar ventral cutting plates at its oral margin, and in its depth there were two subventral lancets. The oesophagus was club-shaped. It measured about 706 μ to 128 μ in length, and from 66 μ to 74 μ minimum thickness, and from 124 μ to 128 μ near the posterior end. The nerve ring encircled it about midway. The lateral lobes of the bursa were semi-oval. The medio-lateral ray was about the same thickness as the externo-lateral ray and the postero-lateral ray. The dorsal ray bifurcated distally, and each branch tridigitated. The spicules were equal and measured from 705 μ to 723 μ in length, and were sharply pointed at the tips.

The females vary in length from 7 mm. to 7.9 mm., and in breadth from 300 μ to 335 μ . The general shape of the body and head region is the same as that of the male. The oesophagus varies in length from 793 μ to 864 μ , and from 70 μ to 78 μ minimum thickness to about 123 μ to 169 μ near the posterior end. The vulva is located about 6 mm. from the anterior end of the body. The tail is from 165 μ to 185 μ long, and is terminated by a short spine.

No. Host.

3022, *Vulpes fulva*, (silver fox).

Bunostomum trigonocephalum (Rudolphi 1908).

Only males of this species were found. They vary in length from 13.5 mm. to 14.5 mm. and in breadth from 318 μ to 370 μ . The anterior extremity of the body is bent dorsally. The cuticle is finely striated transversely. The mouth is surrounded by six papillae. The buccal capsule is infundibular with a long dorsal tooth projecting forward. The mouth is armed with two ventral cutting plates. The oesophagus is about 846 μ long, and about 87 μ minimum thickness, and 177 μ maximum thickness near the posterior end.

The bursa is funnel-shaped, the dorsal lobe being shorter than the lateral lobes. The ventral and lateral rays rise from a long common trunk. The lateral rays are long and united at their base. The externo-lateral ray diverges widely

from the other two lateral rays, and is curved ventrally, while the others are curved dorsally. The medio-lateral ray is broader and longer than the postero-lateral ray. The dorsal ray is asymmetrically branched. The right externo-dorsal ray rises near the root, while the left is given off further back. The dorsal ray divides, and each branch subdivides distally. The spicules are equal and are from 670μ to 700μ long, and end in a sharp point.

No. Host.
3023, *Antilope cervicapra*, (blackbuck).

This genus (*Trichostrongylus*) is represented by only one species. The specimens are retained for further study.

No. Host.
3024, *Lagothrix humboldtii*, (woolly monkey).

Obeliscoides cuniculi (Graybill 1923).

Only four specimens were found, one male and three females. The male was 10 mm. long, and 212μ wide. The body is attenuated anteriorly. The cuticle is very finely striated transversely and marked by a prominent longitudinal stria. The head bears three inconspicuous lips and is 37μ broad. There are no head papillae. The oesophagus is 740μ long, and 90μ wide near the posterior end. The cervical papillae are about 466μ from the anterior end. The nerve ring and excretory pore were not observed. There is a pair of prebursal papillae present.

The bursa consists of two lateral and one inconspicuous dorsal rays. The internal surface of the lateral rays, except at the periphery, is covered with small round papillae variable in size, while the periphery is marked by radiating ridges. Each lateral lobe is supported by six well developed rays. The ventro-ventral ray is small and originates from the base of the latero-ventral ray. The rest of the rays form the usual lateral system. The dorsal lobe is small and is supported by the dorsal ray. The externo-dorsal ray is small and slightly curved. The dorsal ray divides into two branches and each branch bifurcates. The spicules are equal and measure 476μ in length, and 25μ at the base, and are cleft distally.

The females vary in length from 17 mm. to 18.5 mm. and in breadth from 388μ to 405μ . The body is striated like the male, and attenuated in both directions from the middle, and there is an abrupt reduction just posterior to the vulva. The head and neck region is like that of the male but somewhat larger. The head diameter is about 70μ . The oesophagus is $1,164\mu$ long, and 165μ wide near the posterior end. The nerve ring and cervical papillae are located 413μ and 462μ respectively from the anterior end. The vulva is a transverse slit located about 4 mm. from the posterior end. The vagina is short. The combined length of the muscular ovijectors is about 494μ . There are two uteri entering the ovijectors anteriorly and posteriorly. The tail is pointed, and the anus is about 227μ from the posterior end. The ova measure about 42μ by 75μ .

No. Host.
3025, *Lepus californicus melanotis*, (Kansas jack rabbit).

Nematodirus sp.

The specimens of this genus were stored in lactophenol, which distorted them so that the specific characters were not clearly indicated.

No. Host.

3026, *Taurotragus oryx*, (eland).

Heligmostrongylus sedecimradiatus (Linstow 1899).

The males vary in length from 10 mm. to 12 mm. and in breadth from 177 μ to 206 μ . The body is long and filiform. The cuticle is very finely striated transversely, and marked by prominent longitudinal striae, of which the dorsal side is extraordinarily developed, and forms a crest which extends the entire length of the body. The head has a long dilated cuticle about 82 μ long. The mouth is provided with six punctiform papillae. The oesophagus is about 480 μ long and 33 μ maximum width. The nerve ring, cervical papillae and excretory pore were not observed.

The bursa is trilobed. The posterior lobe is well developed but not clearly defined. The ventral and lateral systems rise from a common trunk. The ventrals are united at their base and directed forward. The externo-lateral ray is broad and rises near the base of the ventrals. The medio-lateral ray is met at the anterior third by the postero-lateral, which is long and terminates near the margin of the lobe. The dorsal system arises from a common trunk. The externo-dorsal ray originates near the base and terminates a long distance from the margin of the lobe. The dorsal ray divides early and terminates near the margin of the lobe. On the external side there is a short recurved prong given off about mid-way. The spicules are sub-equal and pointed. They measure from 564 μ to 600 μ in length. The gubernaculum is present, but not clearly defined. The genital cone is well developed.

The females vary in length from 14.5 mm. to 15 mm. and in breadth from 176 μ to 185 μ . The general head and body characters are similar to those of the male. The vulva is situated at the posterior end of the body just anterior to the anus, and is greatly extended. The ovijector and uterus are simple and filled with eggs. The tail is pointed and about 48 μ long. The ova measure about 38 μ by 70 μ .

No. Host.

3027, *Cuniculus paca*, (spotted cavy).

Enterobius sp.

In this genus only females were found and the determination of the species was deferred until more specimens can be collected.

No. Host.

3028, *Cebus capucina*, (white-faced sapa-jou).

3029, *Lagothrix humboldtii*, (woolly monkey).

3030, *Ateles ater*, (spider monkey).

Wellcomia branickii, sp. nov.

Only males of this species were found. However, the following description seems to identify them as new to science. From a correspondence received from Dr. E. W. Price, U. S. Department of Agriculture, Washington, D. C., I quote: "Dr. Chitwood has gone over the specimens of nematodes and is of the opinion that they are *Wellcomia* sp. and probably new."

The males vary in length from 5.468 mm. to 6.879 mm. and in breadth from 546 μ to 705 μ . The body is slightly attenuated anteriorly, and the posterior end is curved ventrally forming a figure six. (See fig. 1a.) The cuticle is transversely striated at intervals of about 18 μ at the oesophageal bulb. There are two cervical alae extending from the head to a point about the junction of the oesophagus and the oesophageal bulb. The excretory pore, and cervical papillae, if any, were not observed. There are three inconspicuous lips, two subdorsal and a single ventral, and three triangular teeth projecting from a short vestibule or pharynx. The subdorsal lips bear six papillae, four submedian and two amphids. The ventral lip bears no papillae. (Fig. 1b.) The head diameter is about 83 μ . The oesophagus, exclusive of the bulb, is from 470 μ to 580 μ long and is about 105 μ wide at the posterior end. The oesophageal bulb is subspherical, having a diameter of 175 μ to 200 μ . It is supplied with a tripartite chitinized dental apparatus. The nerve ring is about the center of the oesophagus.

There is a preanal vesicular prominence about 200 μ long on the ventral side of the body. (Fig. 1c.) This structure is about 1.25 mm. from the anus. Just posterior to this pad-like structure is a short section of transverse cuticular striations, followed by eight or ten longitudinal striae, broken by transverse striae at intervals of about 28 μ to 30 μ . There is another short section of transverse cuticular striations followed by six or seven longitudinal striae, traversed by twelve to sixteen transverse striae, at intervals of about 30 μ to 37 μ . There is only one spicule present. It is short and curved ventrally. It is about 335 μ long and 20 μ thick at the base. The gubernaculum is flask-shaped and measures from 41 μ to 49 μ long. About 75 μ to 100 μ behind the cloacal aperture the tail suddenly narrows and ends in a conical spine about 75 μ to 100 μ in length. The number and arrangement of the caudal papillae were not definitely determined; however, just before the narrowing of the tail, there is a pair of highly developed postanal papillae, and at least one pair of adanal papillae present.

The characters that distinguish this species from *Wellcomia evoluta* are the peculiar arrangement of the six head papillae, three inconspicuous lips, and the length of the spicule, whereas *Wellcomia evoluta* has no head papillae, the three lips are large and broad, and the spicule is short.

The type is deposited in the laboratory of the New York Zoological Park.

No. Host.

3031, *Dinomys branickii*, (Branick rat).

Wellcomia evoluta (Linstow 1899).

The males vary in length from 4.5 mm. to 5.3 mm. and in width from 264 μ to 388 μ . The body is stout and the posterior end tightly coiled ventrally. The cuticle is finely striated transversely at intervals of about 8 μ at the oesophageal

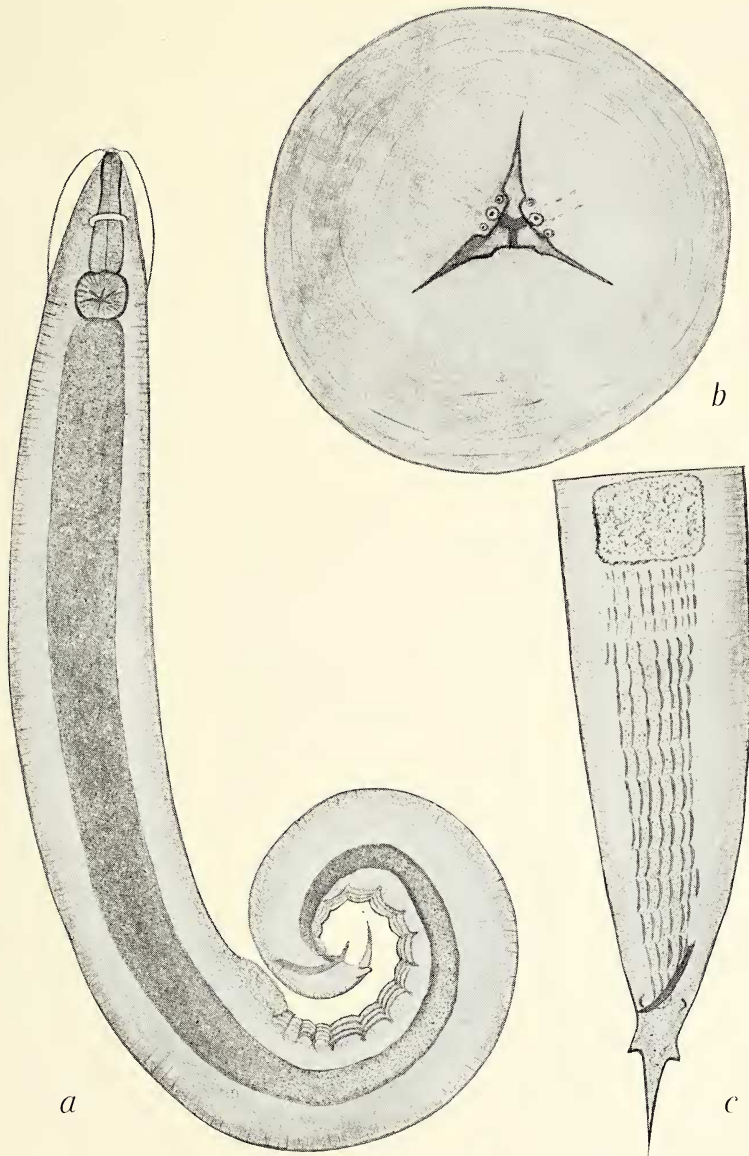


Fig. 1. a, *Wellcomia branickii* sp. n. lateral view of the male, showing various structures and the relative positions of the organs. b, *Wellcomia branickii* sp. n. En face view of the male head, the lip structures and the peculiar arrangement of the papillae. c, *Wellcomia branickii* sp. n. ventral view of the tail of the male showing the preanal vesicular structure, longitudinal striae, spicule, and caudal papillae.

bulb, and also fine longitudinal striae in some specimens. There are two cervical alae extending back less than half the length of the oesophagus. The excretory pore is just posterior to the oesophagus. The cervical papillae, if any, were not observed. There are three large broad lips and between them three intermediate lip structures projecting nearer to the median longitudinal axis. There is an incised cuticular plate forming an anterior pharyngeal border about the lips. There are no head papillae. The head diameter is about 54μ . The oesophagus is club-shaped, measuring, exclusive of the bulb, from 500μ to 529μ long, and about 83μ wide at the posterior end. The oesophageal bulb is separated by a deep constriction from the oesophagus, and is subspherical, 128μ to 136μ long, and 144μ to 148μ thick. It is supplied with a tripartite chitinized dental apparatus. The nerve ring is located about 82μ from the anterior end of the oesophagus. The intestine has at least one anterior and one posterior local dilatation, and finally one large colon-like dilatation, followed by a short narrow tube to the anus.

About 1 mm. anterior to the anus the cuticle is marked by 6 to 8 prominent longitudinal striae, and intercepted by narrow sections of fine transverse striae at intervals of about 100μ . There is only one spicule present. It is short and curved ventrally. It measures from 133μ to 161μ long, and about 12μ thick near the middle. The gubernaculum is flask-shaped and is 33μ to 39μ long. About 91μ behind the cloacal aperture the tail suddenly narrows and ends in a conical spine, about 115μ long. There are two pairs of caudal papillae. One pair of well developed conical adanal, and just before the narrowing of the tail, there is a pair of postanal papillae, which are highly developed in the form of elongated conical rays. There is a thin bursal membrane connecting the post-anal papillae, and extending anteriorly to the adanal papillae.

The females, apparently somewhat immature, vary in length from 9 mm. to 10 mm. and in breadth from 476μ to 617μ at the vulva. The body terminates in a long pointed tail somewhat spiraled. The cuticle is the same as the male except the transverse striae are about 14μ apart. The excretory pore is between the oesophageal bulb and the vulva. The head diameter is about 75μ , and is otherwise the same as the male. The oesophagus varies in length from 794μ to 812μ and is about 140μ wide at the posterior end. The oesophageal bulb varies in length from 211μ to 229μ and in width from 229μ to 247μ , and contains the tripartite chitinized dental apparatus. The nerve ring is located about 140μ from the anterior end of the oesophagus. The intestine is the same as in the male. The anus is a circular aperture 1.76 mm. to 2 mm. from the tip of the tail. The vulva is unique in its character and is situated about 4 mm. or 5 mm. from the anterior end of the body. The distal portion of the vagina extends through a cuticular tube which projects out from the body of the worm, and the vulva is located on the distal extremity of this tube. After entering the body proper there is a swelling of the vagina, which is somewhat constricted near the anterior end to form an oval-shaped seminal receptaculum. The posterior portion forms an extended uterus which divides and turns forward to form the ovaries. The ova measures about 28μ by 74μ .

No. Host.

3032, *Erethizon dorsatum*, (Canadian porcupine).

Aspidodera sp.

Nineteen specimens of this genus were found in the cecum of an armadillo from Brazil. There is a wide variation in the length and shape of the spicules, and these specimens are retained for future study.

No.	Host.
3033,	<i>Euphractus sexcinctus</i> , (armadillo).

Subulura distans (Rudolphi 1809).

The males vary in length from 16 mm. to 21 mm. and in breadth from 476 μ to 687 μ . The body is slightly attenuated anteriorly and the cephalic extremity is terminal. The cuticle has both fine transverse and coarse longitudinal striae. Both cervical papillae and alae are absent. The excretory pore is at the anterior fourth of the oesophagus. The head has a diameter of about 160 μ and bears 6 papillae, 3 on each side of the mouth opening, equidistant and arranged in a straight line. The mouth opening is triangular, with the apex of the triangle pointing ventrally. The sides of the triangle are reinforced by three cuticular plates. A large rigid cuticularised buccal cavity, triangular in cross-section, and about as deep as wide, is present. At the base of this cavity are three complicated teeth arranged radially. The oesophagus is club-shaped, and varies in length from 2 mm. to 2.5 mm. and the maximum thickness near the posterior end about 309 μ . The oesophageal bulb is almost spherical and measures about 335 μ in diameter. The nerve ring is located near the posterior end of the oesophagus. The intestine forms a pear-shaped swelling where it joins the oesophageal bulb.

The tail is always curved ventrally, and sharply pointed. A muscular preanal sucker about 300 μ long is located about 1 mm. from the posterior end of the body. There are eleven pairs of caudal papillae present, three pairs of preanal, two adanal, and six postanal. The preanal papillae are large and fleshy. They are located one on each side of the sucker, one pair mid-way between this and the anus, and the third pair just anterior to the anus. The adanal papillae are large and close to each other. There are two pairs of medium papillae located just posterior to the anus, a short distance from each other. At the tip of the tail are three pairs of medium size papillae. The spicules are equal and filiform measuring from 1.75 mm. to 2.46 mm. The gubernaculum is wedge-shaped and is about 165 μ long.

The females vary in length from 25 mm. to 32.5 mm. and in breadth from 617 μ to 882 μ . The general structures of the anterior region of the body are similar to those of the male except they are larger. The oesophagus varies in length from 265 μ to 325 μ , and is about 230 μ wide at the posterior end. The oesophageal bulb has a diameter of about 388 μ . The vulva is located just anterior to the middle of the body. It communicates with a long muscular ovjector, which terminates in a stout muscular valve. This portion is succeeded by a wider, less muscular portion which gradually gives place to the thin-walled uterus. The uterus divides, and sub-divides into four branches, which fill the entire body cavity. The anus is located about 2.5 mm. from the end of the long

and pointed tail. The ova are large, thick-shelled, and measure 46μ to 63μ long and 30μ to 33μ wide.

No.	Hosts.
3034,	<i>Hylobates hoolock</i> , (hoolock gibbon).
3035,	<i>Symphalangus syndactylus</i> , (black gibbon).
3036,	<i>Cercopithecus cephus</i> , (moustache monkey).
3037, 3038,	<i>Cercopithecus sabaesus</i> , (green monkey).
3039,	<i>Cercocebus fuliginosus</i> , (sooty mangabey).
3040, 3041,	<i>Macaca irus</i> , (Java macaque).
3042, 3043,	<i>Macaca mulatta</i> , (Rhesus monkey).
3044,	<i>Macaca fuscata</i> , (Japanese red-faced monkey).
3045,	<i>Macaca sylvana</i> , (Barbara ape).

Toxocara mystax (Zeder 1800).

The males vary in length from 37 mm. to 60 mm. and in breadth from 829 μ to 970 μ . The body is rather slender, having the anterior end bent ventrally. The cuticle is transversely striated at intervals of about 12 μ . The cervical alae are broad and end somewhat abruptly about one half the length of the oesophagus. The excretory pore is located on the anterior fourth of the oesophagus. The head has a diameter of about 275 μ , and bears six fleshy papillae, two on each lip. The lip pulp contains two distinct lateral lobes and an unpaired internal lobe. The interlabia are absent. The oesophagus measures about 3.23 mm. in length, and 247 μ wide at the posterior end. The oesophagus has a well-developed posterior muscular ventriculus about 318 μ long and 194 μ wide. The nerve ring is located in the anterior fourth of the oesophagus.

The posterior end of the body terminates somewhat abruptly, just behind the anus, in a short conical tail about 114 μ long and 80 μ thick at the base. There are 26 or more pairs of caudal papillae, 6 postanal and 20 or more preanal. The postanal papillae are composed of 2 subdorsal, 1 lateral, 2 subventral, and 1 large double papillae just behind the anus. The preanal papillae are small and are arranged in two long rows along the ventral edges of the body. The spicules are sub-equal and winged. They vary in length from 1.85 mm. to 2.02 mm. and are about 29 μ or 30 μ wide at the base. A gubernaculum is present.

The females vary in length from 48 mm. to 84 mm. and in breadth from 822 μ to 1,411 μ . The cuticle is transversely striated at intervals of about 15 μ to 19 μ . The oesophagus is about 4.65 mm. long, and 305 μ wide. The posterior muscular ventriculus is about 300 μ long and 264 μ wide. The general cephalic structures are similar to those of the male. The vulva is located in the anterior fourth of the body, and the vagina is directed backward. The uterus divides into two tubes, which are filled with eggs. The body terminates rather abruptly in a conical process, about 670 μ long, and the base about 547 μ . The eggs are almost round with a corrugated shell, measuring about 60 μ by 68 μ .

No.	Hosts.
3046,	<i>Felis tigris</i> , (tiger).
3047,	<i>Acinonyx jubatus</i> , (cheetah).

Toxascaris leonina (Linstow 1902).

The males vary in length from 30 mm. to 48 mm. and in breadth from 600 μ to 776 μ . The body is bent ventrally at each end. The cuticle is transversely striated at intervals of 6 μ to 7 μ . The cervical alae are long and narrow, gradually decreasing in width posteriorly. The excretory pore is located on the anterior fourth of the oesophagus. The head has a diameter of about 190 μ , and bears six fleshy papillae, two on each lip. The labial pulp shows two anterior lobules, detached from the main pulp by a well-marked cleft, and presenting a shallow depression at their extremities. The interlabia are absent. The oesophagus measures about 3.5 mm. in length and about 260 μ wide at the posterior end. There is no posterior muscular ventriculus present. The nerve ring is located in the anterior fourth of the oesophagus.

The posterior end of the body terminates gradually into a fine point. The tail is about 165 μ long. The caudal papillae are about the same as described for *Toxocara mystax*, except there are more preanal papillae, 25 or more, and these are larger and not so difficult to see. The spicules are sub-equal and pointed. They vary in length from 1.28 mm. to 1.32 mm. and in width from 24 μ to 29 μ . As a rule they are extended. A gubernaculum is absent.

The females vary in length from 40 mm. to 68 mm. and in breadth from 600 μ to 970 μ . The cuticle is transversely striated at intervals of about 7 μ or 8 μ . The oesophagus is about 4 mm. long and 317 μ wide. The general cephalic structures are similar to those of the male. The vulva is located about the junction of the anterior and middle third of the body. The vagina is directed backward, and the uterus divides into two branches, which are usually filled with eggs. The tail terminates in a conical process about 600 μ long and 350 μ wide at the base. The eggs have a thick smooth shell, about 65 μ by 82 μ .

No.	Hosts.
3048,	<i>Felis tigris</i> , (tiger).
3049,	<i>Acinonyx jubatus</i> , (cheetah).

Toxascaris transfuga (Rudolphi 1819).

The males vary in length from 90 mm. to 130 mm. and in breadth from 2 mm. to 3 mm. The body is stout, with caudal end curved ventrally. The cuticle is transversely striated at intervals of about 10 μ to 12 μ . The cervical alae are long and narrow gradually decreasing in width posteriorly. The excretory pore is located about the center of the oesophagus. The head has a diameter of about 635 μ and bears six fleshy papillae, two on each lip. The lip-pulp is typical of *Toxascaris*. The interlabia are absent. The oesophagus measures about 5.5 mm. long, and 970 μ thick at the base. There is no posterior muscular ventriculus present. The nerve ring is located on the anterior half of the oesophagus. The posterior end of the body ends gradually in a fine point. The tail is about 600 μ long. There are 62 irregular pairs of caudal papillae present, 56 preanal and 6 postanal. The arrangement of the postanal papillae is about the same as in *Toxascaris leonina*. There are two sub-equal spicules, stout and spine-like, about 800 μ long. A gubernaculum is absent.

The females vary in length from 120 mm. to 225 mm. and in breadth from 2 mm. to 5 mm. The body is long and stout. The general cephalic characters are similar to those of the male. The vulva is located in the anterior third of the body. The vagina is directed backward, about 3 mm. and the uterus divides into two branches. The body terminates gradually into a short cone, about 1 mm. long. The eggs have a thick smooth shell, about 66μ by 86μ .

No. Host.

3050, *Thalarcos maritimus*, (polar bear).

Gongylonema pulchrum Molin 1857.

Only one specimen of this species was found. It was believed to have been correctly identified as *G. pulchrum*, although it was smaller than the descriptions given in the literature. It may have been an immature specimen. No detailed description will be given here.

No. Host.

3051, *Pithecus entellus*, (Langur).

Physaloptera caucasica von Linstow 1902.

The characters of these specimens agree perfectly with descriptions given for *Physaloptera caucasis*, except that there is an extra pair of caudal papillae, which are very small and difficult to see, located between the fourth and last pair of papillae. It is believed that the addition of this extra pair of papillae is not sufficient evidence for the erection of a new species. It is possible, however, that this is a variation or may have been overlooked in previous descriptions.

The males vary in length from 33 mm. to 36 mm. The body is slightly attenuated anteriorly. The cuticle, which shows a very delicate transverse striation, sometimes covers the lips. The cervical papillae are lateral and are situated on the anterior fourth of the muscular portion of the oesophagus. The excretory pore opens ventrally and is located from 86 to 128 microns further back. From the head there are two large, rounded lateral lips. Each is surmounted by a large external triangular tooth and a single small spike-like median internal tooth. Near the dorsal and ventral edges of the lip there is a bifid tooth, lodged in a prominent elevation of the lip. Between these teeth and the median tooth, slightly below the base of the bifid teeth, there are irregular rows of small denticles. Each lip carries a large dome-shaped external papilla on each submedian line. The oesophagus forms a fraction over one-sixth of the total length of the body. The anterior one-tenth, which is slightly thinner than the rest forms the glandular part, and the nerve ring encircles it in the posterior third.

The bursa is long, pointed and reflexed ventralwards. Its ventral surface is ornamented with small triangular spike-like processes arranged longitudinally, and extends as far as the sixth pair of postanal ventral papillae. The four pairs of stalked papillae are arranged in two groups, the anterior two pairs being pre-anal and the posterior two pairs postanal in position; the first and last pairs are

shorter than the other two, and their origins are slightly more ventral. There are three preanal ventral papillae. The center papilla is larger, and is nearer the anus. The first two pairs of postanal ventral papillae are small and are close together, one pair behind the other, near the anus; pairs 3 and 4 are approximated to each other, and are situated at the junction of the first and second tail thirds; the fourth pair is nearer the ventral mid-line than the third pair. The sixth pair is found at the junction of the last third. Between these there is a depression-like structure about $25\ \mu$ in diameter. Midway between the fourth and sixth pairs of papillae is the fifth pair, which is very small. The spicules are very unequal, the left being long and filiform, measures from 2 mm. to 3 mm. in length, and from $20\ \mu$ to $24\ \mu$ in breadth. The right spicule is short and stout, measuring $352\ \mu$ long and about $55\ \mu$ wide at the base.

The females vary in length from 36.5 mm. to 44 mm. and in breadth from $847\ \mu$ to $1,182\ \mu$. The body is large and stout, the anterior two-thirds taper gradually towards the cephalic extremity; the posterior one-eighth tapers to the end in a short conical tail. The general cephalic structures are similar to those of the male. The vulva is situated on a slight elevation near the posterior end of the oesophagus. It leads into a thick-walled vagina about 2 mm. to 3 mm. long and about $88\ \mu$ in diameter; this passes gradually into the egg-chamber, which is about 4 mm. long, and $441\ \mu$ wide. The common trunk which follows it is about 1 mm. long and $100\ \mu$ in diameter. The four uteri arise dichotomously, the last two branches about 3 mm. from the first two, and are twisted about each other in a complicated manner. The eggs are oval and thick-shelled, and vary from $33\ \mu$ to $39\ \mu$ by $45\ \mu$ to $51\ \mu$.

No. Host.

3052, *Macaca sylvana*, (Barbara ape).

Physaloptera maxillaris Molin 1860.

The measurements of the spicules are somewhat less than the figures given by Ortlepp (1922). This is perhaps due to the immaturity of the specimens at hand.

The males vary in length from 19 mm. to 25 mm. and in breadth from $550\ \mu$ to $900\ \mu$. The body is attenuated from behind forwards, having their maximum thickness just above the bursa. The cuticle is finely striated transversely, and is partly or wholly reflected over the lips. The cervical papillae are situated about $500\ \mu$ behind the junction of the two oesophageal parts, and the excretory pore about $50\ \mu$ further back. The lips are rounded or slightly conical; each has two terminal teeth, a large triangular outer tooth with obtuse tip slightly bent outwards, and an inner semimembranous tooth, tripartite at its free end, and of the same size as the outer tooth. Two large conical papillae are present on the outer surface of each lip. The oesophagus is straight, and thickens gradually toward its posterior end. It varies in length from 4.2 mm. to 4.4 mm. and in width from $390\ \mu$ to $400\ \mu$; its anterior tenth forms the muscular part, which is slightly thinner than the glandular, and is encircled by the nerve cord in its posterior third.

The bursa is elongated and somewhat pointed, and has its caudal expansion well developed in its middle portion. Its ventral surface is ornamented by two types of cuticular bosses, those in the central area, above and below the anus, being rounded, while those on the lateral areas are in the form of much-broken ridges. The four circumcloacal lateral papillae are provided with very long stalks, especially the second and third pairs. There are three small preanal papillae in a row near the anus, and two pairs of postanal papillae also in a row near the anus. Further down the tail there are three additional pairs; these are equidistant from each other, the most anterior being situated just behind the level of the last pair of stalked papillae. The spicules are slightly bent ventrally. They are unequal and the right is about 735μ long and 56μ wide. The left is about 973μ long, and 41μ wide.

The females vary in length from 20 mm. to 28 mm. and in breadth from 839μ to 953μ . The body is stout, and attenuated only in the anterior third and tail regions. The general cephalic characters are similar to those of the male. The vulva is slightly protuberant, and located just posterior to the base of the oesophagus. The vagina is long and varies in length from 2 mm. to 3 mm. and about 86μ wide. There is an elongated egg-chamber followed by a short common duct of the two uteri. The tail is rounded, and measures about 425μ long. The ova are oval and thick-shelled, and measure about 31μ by 45μ .

No. Host.

3053, *Mephitis mephitis*, (Canadian skunk).

Physaloptera torresi (Travassos 1920).

The males vary in length from 38 mm. to 48 mm. and in breadth from 1 mm. to 2 mm. The body is stout and attenuated anteriorly. The cuticle is finely striated transversely, and is partially or wholly reflected over the lips. The cervical papillae are situated about the level of the junction of the two oesophageal parts, and the excretory pore about 265μ further back. There are two sub-triangular lips, each with four external papillae, and one apical and median papilla. There are three teeth present on the tip of each lip, the median being larger and more internal in position than the other two; it is about 17μ in length. The oesophagus is claviform, 6 mm. to 8 mm. in length and 582μ to 688μ wide; its muscular part is up to 767μ long.

The bursa has well developed alae. There are four pairs of lateral circumcloacal pedunculated papillae. There are three sessile papillae in front of the anus and two pairs of sessile papillae in a row immediately behind the anus; three further pairs are equidistant from each other in the anterior half of the tail. The spicules are subequal and weakly chitinized; they vary in length from 500μ to 882μ . The anus is about 3 mm. from the caudal extremity.

The females vary in length from 70 mm. to 100 mm. and in breadth from 2 mm. to 2.5 mm. The body is long and stout. The general cephalic characters are similar to those of the male. The vulva is located about midway down the oesophagus. There is a long vagina, about 3 mm., which widens to form the egg-chamber. This organ gives rise directly to the uteri, which vary in number

from nine to eleven. The eggs are oval, thick shelled, and measure about 28μ by 42μ . The anus is about 1 mm. from the posterior extremity.

No.	Hosts.
3054, 3055,	<i>Cuniculus paca</i> , (spotted cavy).
3056,	<i>Dasyprocta agouti</i> , (golden agouti).

Physaloptera sp.

A small number of hosts carried members of this genus in their stomachs. The specimens that were stored in lactophenol became so deteriorated that specific characters were uncertain.

No.	Hosts.
3057,	<i>Hylobates hoolock</i> , (hoolock gibbon).
3058,	<i>Symphalangus syndactylus</i> , (black gibbon).
3059,	<i>Cercopithecus sabaesus</i> , (green monkey).
3060, 3061,	<i>Cebus capucina</i> , (Sapajou monkey).

Dipetalonema gracile (Rudolphi 1809).

The males vary in length from 80 mm. to 95 mm. and in breadth from 352μ to 388μ . The body is filiform and tapers toward each extremity. The posterior region of the tail is spirally rolled. The cuticle appears to be smooth, but may sometimes show transverse striations near the caudal extremity. The head has a diameter of about 90μ , and the mouth consists of a chitinous ring, with three lip-like processes. Boulenger (1920) gives six head papillae, Yorke and Maplestone (1926) figures only six, van Thiel (1926) states that there are five small papillae, not mentioned by previous authors. This would make a total of eleven head papillae. I have been able to determine only ten, five on each end of the rectangular prominence around the mouth opening. The anterior muscular part of the oesophagus is about 511μ long, and the posterior glandular part is about $3,352 \mu$ long, making a total of about $3,863 \mu$. The nerve ring encircles it about 260μ from the anterior extremity.

There are three or four pairs of ventral preanal papillae near the anus. Just posterior to the anus is a pair of postanal papillae. There is also a small group of postanal papillae near the tip of the tail, two pairs of lateral, and two single ventrals, one midway between the laterals, and one just anterior to them. There are two very unequal spicules. The left spicule is about 1.03 mm. long and about 12μ broad at its base. It consists of an anterior tubular region about 301μ long, followed by a long thin terminal region. The right spicule measures about 270μ and about 12μ wide at the base. It also has the shape of a tube, and terminates in a membranous hooked extremity. The gubernaculum is about 16μ long. The anal opening is about 238μ from the posterior extremity.

The females vary in length from 160 mm. to 217 mm. and in breadth from 564μ to 600μ . The body is long and filiform. The head and general cephalic characters are similar to those of the male. The anterior muscular part of the oesophagus is about 556μ long, and the posterior glandular part is about 3 mm.

long, making a total of about 3.556 mm. The vulva is situated about 1.15 mm. from the anterior extremity of the body. The vagina is long and directed posteriorly. It has a length of about 8 mm. Near the caudal region there is a pair of elongated appendages, about 30 μ from the end of the body. The anus is about 630 μ from the posterior extremity of the body. The worms are ovoviparous, having thin-shelled eggs about 17 μ by 22 μ , and microfilariae near the vulva.

No.	Hosts.
3062, 3063,	<i>Cebus apella</i> , (weeper sapajou monkey).
3064,	<i>Cebus capucina</i> , (white-faced sapajou monkey).
3065,	<i>Lagothrix humboldtii</i> , (woolly monkey).
3066,	<i>Ateles ater</i> , (spider monkey).

VI. BIBLIOGRAPHY.

- BAYLIS, H. A.
1920. Notes on Some Parasitic Worms from East Africa. *Ann. Mag. Nat. Hist. London*, Ser. 9, 6, 283-295.
- BAYLIS, H. A.
1922. Notes on Some Parasitic Nematodes. *Ibid.* 9, 9, 494-504.
- BAYLIS, H. A.
1928. On a Collection of Nematodes from Nigerian Mammals (chiefly rodents). *Parasitology*, 20, 280-304.
- BAYLIS, H. A.
1929. A Manual of Helminthology, Medical and Veterinary. 276 pp. Wm. Wood and Co., New York.
- BAYLIS, H. A. AND DAUBNEY, R.
1922. Report on the Parasitic Nematodes in the Collection of the Zoological Society of India. *Mem. Ind. Mus. Calcutta*, 7, 263-347.
- BAYLIS, H. A. AND DAUBNEY, R.
1926. A Synopsis of the Families and Genera of Nematoda. 255 pp. Richard Clay and Sons, Limited, Bungay, Suffolk.
- BOULENGER, C. L.
1920. Filariid Worms from Mammals and Birds in the Society's Gardens, 1914-1915. *Proc. Zool. Soc. London*, Part IV., 491-506.
- CAMERON, T. W. M.
1930. The Species *Subulura* Molin in Primates. *J. Helminthology*, 8, 49-58.
- CANA VAN, W. P. N.
1929. Nematode Parasites of Vertebrates in the Philadelphia Zoological Garden and Vicinity. I. *Parasitology*, 21, 63-102.
- CANA VAN, W. P. N.
1931. Nematode Parasites of Vertebrates in the Philadelphia Zoological Garden and Vicinity. II. *Parasitology*, 23, 196-229.
- CHANDLER, A. C.
1924. Some Parasitic Round Worms of the Rabbit with Descriptions of New Species. *Proc. U. S. Nat. Mus.* 66, Art. 16.

- CHANDLER, A. C.
1930. Specific Characters of the Genus *Trichuris* With a Description of a New Species, *Trichuris tenuis*, from a Camel. J. Parasit. 16, 198-206.
- FLOWER, S. S.
1929. List of the Vertebrated Animals Exhibited in the Gardens of the Zoological Society of London, 1828-1927. 381 pp. Zoological Society of London, England.
- FOX, H.
1923. Disease in Captive Wild Mammals and Birds. 665 pp. J. B. Lippincott Co., Phila.
- GOODEY, T.
1923. *Necator americanus* and the Domestic Pig. J. Helminthology, 1, 161-164.
- GOODEY, T.
1924. Oesophagostomes of Goat, Sheep and Cattle. *Ibid.* 2, 97-110.
- GRAYBILL, H. W.
1923. A New Genus of Nematodes from the Domestic Rabbit. Parasitology, 15, 340-342.
- HALL, M. C.
1916. Nematode Parasites of Mammals of the Orders Rodentia, Lagomorpha, and Hyrocoidea. Proc. U. S. Nat. Mus. 50, 1-247.
- HEGNER, R., ROOT, F. M., AND AUGUSTINE, D. L.
1929. Animal Parasitology, 640 pp. Century Co., New York.
- IHLE, J. E. W.
1922. On *Oesophagostomum apistomum* (Willach) and some remarks on the Classification of the Strongylidae. Bijdr. Dierk. Amsterdam Feest-Nummer. 22, 89-94.
- ORTLEPP, R. J.
1922. The Nematode Genus *Physaloptera*. Proc. Zool. Soc. London, Part IV., 999-1108.
- ORTLEPP, R. J.
1923. Two New Nematodes Collected in the Zoological Gardens of London. J. Helminthology, 1, 61-64.
- ORTLEPP, R. J.
1924. On a Collection of Helminths from Dutch Guiana. *Ibid.* 2, 15-40.
- PRICE, E. W.
1928. Two New Nematode Worms from Rodents. Proc. U. S. Nat. Mus. 74, Art. 4.
- RANSOM, B. H.
1911. The Nematode Parasites in the Alimentary Tract of Cattle, Sheep, and other Ruminants. U. S. Dept. Agric. Bureau Animal Industry, Bull. 127.
- RANSOM, B. H.
1925. Hookworms of the Genus *Uncinaria* of the Dog, Fox, and Badger. Proc. U. S. Nat. Mus. 65, Art. 20.

- SANBON, L. W.
1925. *Gongylonema*. J. Trop. Med. and Hyg. 28, 313-316.
- SCHWARTZ, B.
1925. A New Species of Hookworm from a North American Raccoon. Proc. U. S. Nat. Mus. 67, Art. 26.
- SCHWARTZ, B.
1926. Specific Identity of Whipworms from Swine. J. Agric. Res. Washington, 33, 311-316.
- STILES, C. W. AND HASSAL, A.
1920. Index-Catalogue of Medical and Veterinary Zoology, Nematoda, Gordiacea, and Acanthocephali. 886 pp. Government Printing Office, Washington, D. C.
- TAYLOR, E. L.
1924. On the Ascarids of the Dog and Cat. Ann. Trop. Med. Par. 18, 243-252.
- THORNTON, H.
1924. A Review of the Oesophagostomes in the Collection of the Liverpool School of Tropical Medicine. *Ibid.* 18, 393-408.
- THWAITE, J. W.
1927. On a Collection of Nematodes from Ceylon. *Ibid.* 21, 225-244.
- TRAVASSOS, L.
1915. Contribuições para o conhecimento da fauna helmintoljica brasileira. V. Sobre as especies brasileiras do genero *Capillaria* Zeder, 1800. Mem. Do. Inst. Oswaldo Cruz, 7, 146.
- TRAVASSOS, L.
1921. Contribuições para o conhecimento da fauna helmintoljica brasileira. XIII. Ensaio monografico da familia Trichostrongylidae Leiper, 1909. Mem. Do. Inst. Oswaldo Cruz, 13, Art. 1.
- UNDERHILL, B. M.
1920. Parasites and Parasitosis of the Domestic Animals, 357 pp. Macmillan Co., N. Y.
- VAN THIEL, P. H.
1926. On Some Filariae Parasitic in Surinam Mammals, with the Description of *Filariosis asper* n. g. n. sp. Parasitology, 18, 128-136.
- WALTON, A. C.
1927. A Revision of the Nematodes of the Leidy Collection. Proc. Acad. Nat. Sci. Phila., 79, 49-163.
- WARD, H. B. AND WHIPPLE, G. C.
1918. Fresh-Water Biology. 1111 pp. John Wiley and Sons, Inc., N. Y.
- YORKE, W. AND MAPLESTONE, P. A.
1926. Nematode Parasites of Vertebrates. 536 pp. P. Blackiston's Son and Co., Phila.